made to pass through the cylinder, a colourless stratum was seen to extend downwards from the surface. The separating surface was sharply defined at first, but after a few minutes a number of secondary stratifications appeared, which on close inspection showed wavy outlines. Many of them were of a deeper blue, *i.e.* cooler, at their upper than at their lower surfaces, so that there was evidence of a vortex-like motion in the liquid. For really trustworthy results Mr. Wachsmuth used an arrangement of two copper plates and a thermopile, the lower plate being placed in contact with ice.

THE volume on "The Partition of Africa," by Mr. J. Scott Keltie, which has been for some time in preparation, will be issued in a few days by Mr. Stanford. The work, which has been brought thoroughly up to date, is illustrated by a carefully-selected series of facsimiles of early maps, as well as by a number prepared specially to show the present condition of the continent in its many different aspects.

MR. A. E. SHIPLEY, Fellow of Christ's College, Cambridge, and Demonstrator of Comparative Anatomy in the University, has been for some time engaged on an illustrated text-book of invertebrate zoology, which will be published (Adam and Charles Black) early in the spring. It is specially adapted for the use of University students reading for such examinations as the first part of the Natural Sciences Tripos, or for the B.Sc. degree in London.

MESSRS. MACMILLAN AND CO. have published a second edition of Mr. D. E. Jones's "Examples in Physics." The book has been carefully revised, and some sixty pages of matter have been added. New sets of problems from recent papers have been put in the place of the examination questions at the ends of the chapters.

THE first volume of the *Seismological Journal* is now in the press, and will shortly be issued. It is uniform in size and in character with the Transactions of the Seismological Society, and will correspond with what would have been volume XVII. of those publications had they been continued. The yearly subscription for the journal is 5 yen, 5 dollars, or £1. This includes delivery or postage. It may be paid by P.O.O. or a draft on any foreign bank in Yokohama. Address, John Milne, 14, Kaga Yashiki, Tokio.

MESSRS. WHITTAKER AND CO. have published "The School Calendar and Handbook of Examinations, Scholarships, and Exhibitions, 1893." This is the seventh year of issue. A preface is contributed by Mr. F. Storr.

A DEFINITELY crystallised compound of iron and tungsten of the composition FeW_2 is described by Drs. Poleck and Grützner, of the University of Breslau. The crystals of this interesting substance were discovered in drusy cavities of a massive piece of a crystalline iron-tungsten alloy containing no less than 80 per cent. of tungsten. The alloy had been prepared by an electrolytic process from *wolframite* at the works of Biermann's Metal Industry in Hanover, and exhibited in the numerous cavities small but very well-formed crystals of a silver-grey colour and exhibiting very brilliant faces. They were extremely heavy and of exceptional hardness. Upon analysis they yielded numbers corresponding closely with those calculated for the compound FeW_2. Dr. Milch, of the Mineralogical Department of the University, subjected the crystals to a goniometrical investigation, and found them to consist of trigonal prisms whose faces were inclined exactly at 60°, and which were terminated by a basal plane inclined exactly at 90°. Singularly, however, no other faces were ever discovered upon them, so that it was impossible to ascertain to what sub-section of the hexagonal system the crystals belonged. The crystals are so hard that they readily scratch topaz, and appear to be of about the same hardness as corundum.

THE discovery of these crystals of a definite compound of iron and tungsten, and the fact that they are endowed with such a high degree of hardness, afford a ready explanation of the long-known property of tungsten in improving the hardness of steel. Berzelius, in his *Lehrbuch*, already remarked that tungsten readily formed alloys with most of the other metals, and in the year 1858 Muchet in this country took out a patent for the employment of tungsten in the manufacture of steel. Thereupon the wolfram minerals, previously considered as almost worthless, rapidly came to acquire a considerable value. Bernoulli has since shown that tungsten is capable of alloying in all proportions with iron until it reaches a proportion of 80 per cent., when the mass becomes infusible even at the hottest procurable white heat. This alloy containing so high a percentage of tungsten, approximating indeed to that (86·4) contained in the crystals above described, exhibits a silver-grey lustre like that of the crystals and possesses almost the same hardness, scratching glass and quartz with ease. Latterly the manufacture of this alloy has been carried on at the Hanoverian metal works above referred to, and brought into commerce. There can be little doubt that the remarkable property of tungsten in increasing the hardness of steel is due to the formation of more or less of this compound FeW_2, and the nearer the proportions of the two metals approach to those of the compound itself the more nearly does the resulting alloy approach in hardness to that displayed by the crystals of FeW_2 above described.

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus*, ♀) from India, presented by Capt. U. Cooke; a Two-spotted Paradoxure (*Nandinia binotata*) from West Africa, presented by Lady Fleming; a Brush-tailed Kangaroo (*Petrogale penicillata*, ♂), two Black-striped Wallabys (*Halmaturus dorsalis*, ♀ ♀) from New South Wales, presented by Mr. Wilberforce Bryant; a Mauge's Dasyure (*Dasyurus maugæi*) from Australia, presented by Mr. Robert Hoare; a Red and Yellow Macaw (*Ara chloroptera*) from South America, presented by Mr. H. H. Dobree; a Grey Parrot (*Psittacus erithacus*) from West Africa, presented by the Executor of the late Mrs. Bolaffe; an Æthiopian Wart Hog (*Phacochœrus æthiopicus*, ♂) from Matabeleland, South Africa, deposited; two Chukar Partridges (*Caccabis chukar*, ♂ ♀) from North-west India, presented by Major Ingoldsby Smythe; fourteen Prairie Marmots (*Cynomys ludovicianus*, 6 ♂ 8 ♀) from North America, an Arctic Fox (*Canis lagopus*) from the Arctic Regions, two Rufous Tinamous (*Rhynchotus rufescens*) from Brazil, purchased; three Black and Yellow Cyclodus (*Cyclodus nigro-luteus*), three Diamond Snakes (*Morelia spilotes*), a Short Death Adder (*Hoplocephalus curtus*), a Purplish Death Adder (*Pseudechis porphyriaca*), a North Australian Banded Snake (*Pseudonaia nuchalis*) from New South Wales, received in exchange.

OUR ASTRONOMICAL COLUMN.

COMET HOLMES (1892 III.).—During the past week no very important change has taken place in the appearance of the comet; the following is the current ephemeris:—

Ephemeris for 12*h*. *M. T. Paris.*

1893.	R.A. app.			Decl. app.		
	h.	m.	s.	°	′	″
Feb. 9 ...	1	56	29·3 ...	+34	0	28
10 ...	1	58	3·3 ...		2	18
11 ...	1	59	37·8 ...		4	12
12 ...	2	1	12·8 ...		6	9
13 ...		2	48·3 ...		8	9
14 ...		4	24·4 ...		10	13
15 ...		6	0·9 ...		12	20
16 ...	2	7	37·9 ...	34	14	30

Mr. Fowler writes from South Kensington:—"The comet on February 6 was a very dim nebulosity without sensible nucleus."

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COMET BROOKS (NOVEMBER 19, 1892).—The following is the ephemeris for Comet Brooks for the ensuing week :—

Ephemeris for 12h. M. T. Berlin.

1893.	R.A. app.	Decl. app.	Log *r*.	Log Δ.	Br.
	h. m. s.	° ′			
Feb. 9 ...	0 11 33 ...	+30 2·9 ...	0·1167 ...	0·1832 ...	1·40
10 ...	13 19 ...	29 31·2			
11 ...	15 1 ...	29 0·9			
12 ...	16 40 ...	28 31·8			
13 ...	18 15 ...	28 4·0 ...	0·1252 ...	0·2152 ...	1·16
14 ...	19 47 ...	27 37·3			
15 ...	21 17 ...	27 11·6			
16 ...	22 44 ...	26 46·9			

SPECTRA OF PLANETARY NEBULÆ AND NOVA AURIGÆ.—In the December number of the *Memorie della Società degli Spettroscopisti Italiani*, among many interesting communications, is one by M. Eugen Gothard, relative to the great similarity between the spectra of the late Nova and the planetary nebulæ. By the aid of a 10¼-inch reflector and a 10-inch objective prism, together with Schleussner's orthochromatic plates, he has been able to obtain these photographs, the wave-lengths of the lines of which are given in the table below. In the memoir copies of the photographs on a somewhat larger scale are given, that of the Dumb-bell nebula (G.C. No. 4447) showing the image of the nebula itself, just as if no prism had been used. The wave-lengths of the Nova given in this table were obtained from photographs taken on September 27 with 2h. 15m. exposure, and on October 28 with 3h. exposure, and, in M. Gothard's words, "gave the surprising result that the spectrum of the new star perfectly agrees with that of the planetary nebulæ."

The following is the table of the wave-lengths, lines I., II., VI., and VII. representing the nebula lines, and III., IV., and V. the hydrogen lines :—

		I.	II.	III.	IV.	V.	VI.	VII.
(1) G.C. No. 4447 ...	—	502	—	434	411	396·5	386·5	373
(2) ,, 4964 ...	—	501	470	434	409	397	386·5	—
(3) ,, 4373 ...	—	502	—	434	410	396·5	386·5	373
(4) ,, 4514 ...	—	502	—	434	410	396·5	385·7	371
(5) ,, 4628 ...	—	501	468	434	408·5	396	386·5	372
(6) N.G.C. ,, 7027 ...	—	500·7	464	434	410	395	385·7	—
(7) ,, 6891 ...	—	502	—	434	410	396	386·5	372
(8) ,, 6884 ...	—	500·5	—	434	—	395	386·5	—
(9) Nova	582	500	464·2	434	407·7	395	385·5	372

SUN-SPOTS AND MAGNETIC PERTURBATIONS IN 1892. - In an article under this heading in *Astronomy and Astrophysics* for January M. Ricco brings together the facts relative to these two phenomena, the magnetic perturbations being taken from the photo-magnetographs of the United States Naval Observatory. As the author describes in detail both kinds of observations, and in addition, a tabulated statement of the records, we cannot do better than abridge the table, by omitting the numerical statements as to the magnitudes of the spots and perturbations, leaving our readers to refer if necessary to the journal itself.

In the column "spots" this means principal spots ; E denotes extraordinary ; V.L, very large ; L, large ; M, medium ; S, small ; and N, none.

Transit Centre Meridian.	Spots.	Helio-graphic latitude.	Time of Maximum.	Mag. Pertur-bations.	Retar-dation in time.
					h.
Jan. 4, 2 p.m. ...	V.L	+20	Jan. 6, 4 a.m.	V.L	38
Jan. 28, 3 p.m.	L	–16	Jan. 29, noon ...	L	21
Feb. 2–4	N	—	Feb. 2–4	S	—
Feb. 12, 4 a.m.	E	–30	Feb. 14, 1 a.m.	E	45
March 1–5 ...	N	—	March 1–5 ...	M	—
March 7, 2 a.m.	N	—	March 7, 2 a.m.	L	—
March 10, 2 p.m.	E	–29	March 12, 11 a.m.	V.L	45
April 23, 8 p.m.	L	+11	April 25, 11 p.m.	L	51
April 24, 4 p.m.	L	+16	April 26, 1 p.m.	L	45
May 1–2	N	—	May 1–2	M	—
May 16, 5 p.m.	E	–16	May 18, 6 p.m.	E	49

From this table some very interesting facts may be gathered. Out of the eleven cases which M. Ricco gives, no less than seven instances occur where the passage of the spots over the central meridian is followed by a terrestrial magnetic disturbance, and not only this, but the magnitudes of both vary directly. The point which the author wishes to emphasize most is the apparent constancy of the interval of time between these two phenomena, and an important fact is that at both appearances of the great February spot the same retardation occurred. In the above table, with the exception of January 29, the mean interval is 45½ kms., "thus indicating a velocity of propagation from the sun to the earth of about 913 kms. per second," or "more than 300 times less than that of light."

NEW MINOR PLANETS.—Photography seems to be rapidly increasing the number of our minor planets, that is to say, if the announcements really refer to new ones. Wolf and Charlois between them have discovered five this year, the former two (1893 B and C), the latter three (1893, A, D, and E).

THE LUNAR SURFACE.—At the present day the general idea with regard to the peculiar features of the moon is that they are the results of stupendous volcanic actions, the number and activity of which surpassed anything that we can imagine. Owing to the extraordinary circularity in the craters, ring plains, walled plains, and to the well-known fact that many of the craters have not the raised lava floor half-way up or near the summit of the cone, which is such a typical terrestrial characteristic, doubt as to their volcanic origin has often been raised. In a small pamphlet which we have received from Mr. S. E. Peal, Sibsagor Assam, the author suggests a "theory of glaciation" in the light of recent discoveries with regard to the maximum surface temperature, and also to the non-viscosity of ice at low temperatures, together with the admitted possibility of snow existing on the moon. The author assumes the moon to be constituted somewhat like our earth, and at one time to have been at a higher temperature, having an atmosphere, water, &c., and draws attention to the facts that there are no polar caps ; that colour is conspicuous by its absence, "a feature quite opposed to terrestrial experience, except at the poles," and therefore "may not the entire globe be swathed in snow?" ; and the absence of river valleys and drainage sculpturing, indicating that a piling up of dry material has taken place in opposition to a fluvial erosion. At the time when the lunar globe had so far cooled down as to be practically rigid, the tidal action would gradually turn all continents and land surfaces into shoals, and at the temperate stage of development the growth of the polar caps would be restricted to the shallows, extending from them as the temperature became reduced. This advancing sheet of ice would sometimes be deformated by submarine heat vents resulting in a large or small bay, depending on the magnitude of the vent. Extending seawards the "horns of the bay would meet around and enclose this area of higher mean temperature, converting it into a lagoon." Nocturnal radiation and solar heat alternately would perhaps freeze and thaw the ice formed thereon, and with a rare atmosphere and intense cold aqueous vapour would arise from "the water (floe-covered) floor during the day at least, and be carried over the ice edge by diffusion when the fall in temperature would precipitate it into snow, thus gradually forming a vast rampart." Century after century would see the level floor gradually lowered, and the ramparts increased in height. The author accounts for all the peculiar forms of craters, walls, &c., by different local conditions (*i.e.* land or water or submarine vents), but they are all the result "of water floors left in a slowly extending glaciation of the crust."

GEOGRAPHICAL NOTES.

AT the French Congress of Learned Societies, which meets on April 4 at the Sorbonne, the section of historical and descriptive geography, is to be devoted specially to the early geographical conditions of France, and to the work of French travellers. The programme includes the consideration of the earliest traces of human habitations, maps of caverns, &c., and proceeds to classify existing dwellings according to their situation and altitude. Local names in danger of falling out of use are to be collected, and the limits of the old districts such as Brie, Beauce, Sologne, &c., to be investigated in order to place on record the geographical conditions which led to their formation.

IN the *Scottish Geographical Magazine* for February Mr. J. G. Goodchild gives a most interesting description of a large-scale topographical model of the site of Edinburgh, which he has recently constructed. The model, which is on exhibition

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